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Khaya senegalenis Juss. Dry-zone Mahogany

Meliaceae Mahogany family

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HABITAT

Native Range

Khaya senegalenis Juss., dry-zone mahogany, spans the ecotone between high forest and savannah. The range of dry-zone mahogany is from Senegal to Uganda and the Sudan, running almost parallel to the equator between latitudes 8° N., and 14° N., with the eastern part of the range then extending southward (*18, 29,* fig. 1). In moister areas, dry-zone mahogany is found on uplands, but it is restricted to riparian habitats or stream bottoms that extend into the savanna in the drier portions of the range.

Dry-zone mahogany has been successfully grown in plantations in Puerto Rico (*14*), Cuba (*4*), Australia (*19*), Indonesia (*3*), India (*29*), and in several sites in Africa outside its native range (*26*).

Climate

In its native range, dry-zone mahogany grows mostly in the tropical dry forest life zone and along streams in the tropical very dry forest (*17*). Most of the natural range is found within the Sudano-Guinea climatic zone, but the range also extends northward into the Sahelo-Sudanese climate zone (*29*). The Sudano-Guinea climate is characterized by a mean annual precipitation (MAP) of 950 to 1750 mm per year, a dry season of 4 to 5 months, and mean annual temperatures ranging from 24.5 to 28.2 °C. The Sahelo-Sudanese climatic zone has a MAP of 400 to 1000 mm, a dry season of 6 to 8 months, and a mean annual temperature of 26 to 31.5 °C. Summer monsoon rains are the rule in central Africa, but severe droughts occur periodically. Dry-zone mahogany is the most drought hardy of all the species of *Khaya*. The ability of this tree to shed its leaves during the dry season must have considerable survival value. Successful plantations of dry-zone mahogany in other parts of the world have generally been in areas with short dry seasons and high rainfall.

Soils and Topography

As with many tree species, dry-zone mahogany attains its best growth on neutral, deep, fertile, sandy loam soil that is well drained (*6, 29, 30*). Such fertile conditions are often found in alluvial soils where the stream gradient is not too flat. These fertile alluvial soils can be converted to prime agricultural lands, and much of the better dry-zone mahogany sites have been lost to this use. Volcanic soils are also good dry-zone mahogany sites. Dry-zone mahogany usually grows satisfactorily on lateritic soils, but may be stunted on shallow soil over hard laterite (*29*). In the Sudan, natural stands are largely confined to the thin, gravelly, leached soils of ridges and plateaus covered with ironstone crust (*21*). Soil textures across the range of dry-zone mahogany vary from medium to heavy, with clay contents of 12 to 65 percent (*25*). In Africa, the species grows from near sea level to elevations of 1800 m (*30*).

Successful plantings in Puerto Rico indicate tolerance to a wide range of soil conditions: from neutral to very strongly acidic and from very well-drained coarse sandy loam to somewhat poorly drained clay (fig. 2).

Associated Forest Cover

In relic forests of Senegal, dry-zone mahogany is found growing with *Anogeissus leiocarpus* (DC.) Guill. & Perr., *Antiaris africana* Engl., *Ceiba pentandra* (L.) Gaertn, *Adansonia digitata* L., *Ficus spp.*, *Chlorophora excelsa* (Welw.) Benth. & Hook f., *Afraegle paniculata* (Schum & Thonn.) Engl., and *Blighia sapida* Konig (*27*). The savanna forests, which are between the savanna and high forest, support dry-zone mahogany in association with various species of *Acacia, Adansonia digitata* L., and *Kigelia aethiopica* Decne. (*7*). In the high rainfall woodland savannas, dry-zone mahogany is found in pure stands (*24*). Outside its native range, with rare exceptions, dry-zone mahogany will probably remain confined to plantations.

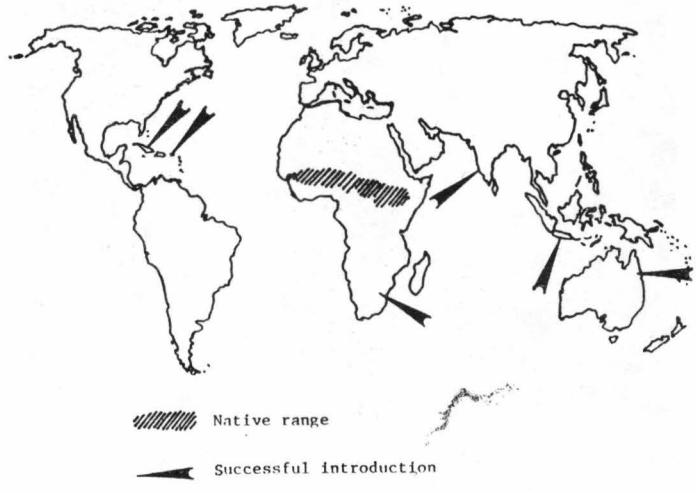

Figure 1.—*Distribution of* Khaya senegalensis.

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LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—The tetramerous flowers of dry-zone mahogany are white with orange disk around the ovary. The flowers are borne on axillary panicles up to 20 cm long (*10*). When the gray colored, four-valved fruit ripens during the dry season, it will change to a black color (*20*).

Seed Production and Dissemination.—Dry-zone mahogany begins to bear seeds when the trees are from 20 to 25 years old. Seed yield is usually heavy. The flat, winged seed is about 3 cm long and 2 cm broad, including the wing (*10*). Normally the number of seeds varies from 6000 to 7000 per kg, but occasionally there will be as few as 3000 per kg (*21*, *30*). About 90 percent of the fresh seeds germinate within 18 days (*30*). Seeds stored for 2 months at room temperature will not germinate; however, seeds will remain viable up to 6 months when stored in sealed metal containers with refrigeration (*13*). Seeds may be dispersed as far as 100 m with the prevailing winds (*29*).

Seedling Development.—Natural regeneration is usually good, but drought and severe competition to the young seedlings from herbaceous vegetation may cause failures (*1*, *29*). Seedlings can survive light to moderate shade.

Strategies to obtain sufficient natural regeneration on poor sites should include liberation cutting of stands with advanced regeneration. Establishment of new seedlings can be encouraged by disturbances such as cultivation or prescribed fire just before seed fall. After seedlings have emerged, a partial cut applied to allow light to reach the forest floor should help seedlings establish themselves well before the final harvest of the existing stand.

Figure 2.—*Twenty-six-year-old* Khaya senegalensis *growing in high rainfall area of Puerto Rico.*

Artificial regeneration is not difficult. Containerized stock is best; however, bare-root and stump plantings have given satisfactory results (*29*). Survival of the seedlings will be improved if the shoots are completely lignified by the time of outplanting. Hoeing and weeding at the onset of the dry season are recommended. Height growth of 1.2 to 1.5 m per year is common for the first 10 years.

Vegetative Reproduction.—Dry-zone mahogany coppices well (*29*). Reproduction may also occur from root suckers (*18*).

Sapling and Pole Stage to Maturity

Growth and Yield—A growth model for the genus *Khaya* has been proposed by Rauh (*16*) in which a monopodial trunk grows rhythmically, developing tiers of branches as it ascends. The model best describes growth in closed stands on good sites where young dry-zone mahogany grow rapidly and produce straight stems and thin, short crowns that allow plenty of light to enter the understory. If extra moisture is available, underplanting of leguminous trees such as *Cassia siamea* Lam., *Albizia lebbek* (L.) Benth., *Leucaena leucocephala* (Lam.) de Wit, or *Dalbergia sissoo* Rexb. will accelerate natural pruning, fix additional nitrogen, and reduce damage by shootborers (*Hypsipyla spp.*) (*29*). The woody legumes should be harvested regularly so they will not compete excessively with the dry-zone mahogany.

Common spacings on cleared and prepared sites are 5 by 5 and 5 by 10 m. A spacing of 5 by 20 m is used when dry-zone mahogany is planted in enrichment or conversion line plantings in riparian forests. Closer spacings have not given satisfactory results (*29*).

The mature height of dry-zone mahogany ranges from 15 to 40 m (*29*) but generally does not exceed 24 m (*11*). The diameter at breast height (d.b.h.) may reach 1.5 m (*30*). Clear boles of 6 m are unusual because the species normally develops a heavily branched crown with age, but in closed riparian stands clear boles of 12 to 15 m are sometimes found (*11*).

A 22-year-old planted stand in South Africa (MAP of 1300 mm) had a mean height of 8.2 m, an average d.b.h. of 11.7 cm, and a density of 650 trees per ha (*26*). A small 23-year-old plantation in Puerto Rico (MAP of 3000 mm) had an average height of 22 m and a mean d.b.h. of 20.1 cm. With irrigation, dry-zone mahogany in Mali, Niger, and Senegal makes an average height growth of 1.3 m per yr (*2*).

Rooting Habit.—Dry-zone mahogany is a deep-rooted species. During the first year, a seedling will develop a strong, deep taproot that provides resistance to frequent droughts (*29*). Buttressing is uncommon (*10*).

Reaction to Competition.—Dry-zone mahogany is moderately shade tolerant. Saplings will either grow up through the light shade of pioneer species or persist in the understory in more shady situations. They will not survive in dense shade, however. Intolerant when mature, dry-zone mahogany must attain a position in the overstory or die. Surviving individuals tend to eventually dominate the stands where they grow. Depending on available moisture and fire history, dry-zone mahogany stands may vary from open (on savannas) to dense riperian stands with little undergrowth. Dry-zone mahogany is usually a subclimax species; in the absence of disturbance, other species will eventually replace it. However, changes are slow and disturbance is frequent in its natural habitat. Except

where selectively removed by logging, dry-land mahogany remains a dominant species in most of its range.

Damaging Agents.—Dry-zone mahogany in its natural range can be severely attacked by *Hypsipyla robusta* Moore. shootborers. Such attacks may result in misshapen trees with no timber value (*12*). In close spacings, plantations can fail due to shootborer attacks (*8*). Species of the Meliaceae (mahogany) family are the hosts of *Hypsipyla* shootborers. In trials where other Meliaceae were absent, dry-land mahogany grew rapidly and straight (*12*). Dry-zone mahogany appears to be less prone to shootborer attack than other species of *Khaya* (*26*). When the species is planted outside of Africa, shootborers are not a problem. Dry-zone mahogany is resistant to *Hypsipyla grandella* Zeller, the shootborer of Meliaceae species in the New World (*23*).

Dry-zone mahogany has been reported as either resistant to termites (*30*) or slightly more resistant to termites than other species of *Khayas* (*10*). The sapwood is susceptible to attack by powder post beetles (*Lyctus spp.*) (*5*). A bacterial disease of dry-zone mahogany in the Sudan caused by *Xanthomonas khayae* Sabet. results in rough, scabby leaf spots and knobby stem cankers (*15*). Although older trees are resistant to fire, seedlings are quite susceptible (*28, 29*).

SPECIAL USES

The sapwood is pinkish tan and the heartwood is an attractive dark red brown. Dry-zone mahogany is harder, heavier, darker, and of finer texture than other *Khaya* species (*26*). The wood density ranges from 0.60 to 0.85, depending on locality (*5*). The sapwood is moderately and the heartwood extremely resistant to preservation treatment. The timber saws well except for a tendency to be wooly in cross grain. It seasons rapidly, with little degrade; however, tension may occasionally cause splitting and warping. Shrinkage from green wood to 12 percent moisture is 2.5 percent radially and 4.5 percent tangentially (*9*). Interlocking grain and slightly aeromatic gum and crystal deposits are common.

African mahoganies have largely replaced American mahoganies (*Swietenia spp.*) in the European markets. Dry-zone mahogany, however, satisfies only a minor part of this demand because of its relatively small log sizes. Dry-zone mahogany is preferred for furniture, high-class joinery, trim, and boat building. The wood is also used locally for railroad ties, flooring, turnery, pulp, fuelwood (caloric value = 19,998 kj/kg), and veneer (*6, 22, 30*). The leafy branches of the tree are looped off for cattle fodder when feed is in short supply (*12*). Dry-zone mahogany is an important urban tree in west Africa (*11*).

GENETICS

No information on the genetics of dry-zone mahogany was found in the literature. However, it is insect pollinated, and it may be assumed that considerable diversity exists across the wide geographic range of dry-zone mahogany.

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